

Essential questions essay



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BUSTER**

1. What is communication?

Communication is by definition the exchange of information between different places. In today's society, people may relay information on the phone or in a conversation. Similarly, in the body, it is common that information needs to travel in order to make decisions or carry out decisions. For example, a person may touch something. The cells that sense contact would communicate the signal for what is being felt across the body to the brain; the person who touches a certain substance would then feel what was touched. This can happen in an instant and often times the body will use reflexes instead.

Touch occurs so quickly, however, that time is vital if someone's life is in danger. If a person were to touch a very hot substance, the body would immediately pull away before they can even have time to react or think. This evolutionary advantage can save someone's life. Other areas of the body relay information as well. The brain is like the AT&T Headquarters of the body; it oversees all information passing between cells, by means of the blood stream, and often tells a certain area to release a signal or secrete a hormone – a chemical signal that allows for certain body functions to occur. However, unlike the game Telephone, the information that is shared between parts of the body is rarely changed and can allow the body to function properly.

2. What are ways communication occurs in machines and in the human body? The brain is made up of neurons that pass communication through the body. This process can be likened unto that of a machine. A machine needs

all parts to function. Similarly, the body needs all of its parts in order to work properly. Also, if a machine has all of its parts, yet some small part of it is malfunctioning, the whole system will fail. This is the same in the body.

On rare occasion, something may be altered or fail to translate in the body, which can cause the whole system to be inoperable. Machines are also very efficient; one single machine can produce thousands of items of merchandise. The body is very productive as well and is able to transfer hundreds of thousands of hormones and signals and impulses every day. Machines can also produce waste of sorts, such as air pollution. Our bodies digest and use substances until they can no longer profit from them. After all the beneficial parts of a food particle is completely used up, the body dispels the waste.

3. What are consequences of miscommunication in the body?

Miscommunication consequences vary depending on the area. Certain parts of the brain are responsible for performing certain tasks. Depending on the area, different bodily functions may be afflicted. If the brain is unable to work properly, the whole body faces the consequences. Yet if something less extreme occurs, such as a single kidney breaking down, the body may still be able to continue without great difficulty. In certain areas of the brain, a specific task is performed. For example, Phineas Gage was working on a railroad when a rod completely shot through his head. His frontal lobe was severely damaged. Because of the area of the brain in charge of personality, decision making, planning, etc. was severely damaged, various sorts of

miscommunication occurred and Gage was never the same person though his body was able to remain functioning in other ways.

4. How do the central nervous system and the peripheral nervous system work together to control the body?

5. What are the functions of the main regions of the brain? The main regions of the brain include: *Frontal Lobe: Part of the brain responsible for reason, planning, movement, emotion, planning, and problem solving.

Temporal Lobe: The section of the brain that stores memory, allows speech, and interprets sound.

Parietal Lobe: Brain segment accountable for recognizing stimuli, movement, position, and recognition.

Occipital Lobe: Allows for visual processing and perception.

Cerebrum: Needed for thought and action. (Contains the “lobes”)

Cerebellum: Associated with the coordination of movement, posture, and balance.

Brain Stem: Vital for breathing, heartbeat, and blood pressure.

Medulla Oblongata: (Part of Brain Stem) Responsible for maintaining breathing and heart rate.

Hypothalamus: Functions include regulating and maintaining homeostasis, emotions, thirst, hunger, and control of the autonomic nervous system.

Hippocampus: Part of the brain important for learning and memory (converting short-term memory to long-term memory) and spatial relationships.

Amygdala: (Located in Temporal Lobe) Involved with memory, fear, and emotion.

Pituitary Gland: Releases hormones that effect growth, sexual development, and metabolism. 6. How do scientists determine which areas of the brain are associated with specific actions, emotions, or functions?

Referring back to Phineas Gage, scientist were able to determine (based on where he was injured and what effect that had on his body) that the Frontal Lobe had something to do with personality traits. In addition, because Gage survived this event, the Frontal Lobe was not entirely vital for the body to function. Incidents such as these have been able to lead scientists to determine what portion of the brain is associated with specific actions, emotions, functions, etc. They study areas of the brains that are effected by various means and further relate that to how that person was effected.

How does communication happen within the body? Communication within the body occurs as parts of the body send messages to other parts. The Nervous System is the primary instructor of what messages are being sent and where. This system is made up of neurons, which communicate using action potential (it is basically, electricity passing through their axons).

What is the basic structure and function of a neuron?

How do the different types of neurons work together to send and receive signals? Neurons transmit signals to each other. The electrical signal passes through their axons, axon terminals, and then to the synapses to where the neurotransmitter (the signal being passed) reaches the dendrites of the next neuron. Action potential is the event where the electrical membrane potential of a cell increases and decreases with consistent trajectory. For this to occur, one neuron sends a signal allowing positive ions into the other neuron. The neuron then releases the neurotransmitters to the dendrites of the receiving cell.

How are electrical impulses created in the human body? For electrical impulses to be created, neurons must be excited. Everything we do is controlled by the electrical signals that run through our bodies. Everything is made up of atoms, which are made of protons, neutrons, and electrons. Protons are positively charged, electrons are negative, and neutrons are uncharged. When these charges are not balanced, an atom will gain either a positive or a negative charge. The switches between these charges allows to flow between atoms.

This flow of electrons is otherwise called electricity. Because of these atoms in our bodies, we can generate electricity and create electrical impulses.

How do neurons convey information using both electrical and chemical signals? Neurotransmitters are the chemical and electrical signals that neurons convey. Electrical signals travel down the axon terminals of a neuron where it tells the vesicles to release neurotransmitters to the synaptic cleft. They then travel to the receptors of the next cell and the

pattern continues. Neurons convey information by transmitting signals to other neurons or types of cells (i. e. muscle cells).

What factors impact our ability to react to a stimulus? When a single part of a machine is unable to function, the entire process is useless. Like this, a neuron is a working machine with multiple parts. If one part of the neuron malfunctions (due to tumors, disease, etc.) then the cell will not be able to transfer information. This would prevent the body from transferring any sort of signals or stimulus. Furthermore, if the body cannot receive a signal at all, regardless of whether or not it could transport it, than we would be unable to react to stimuli.

How and why does reaction time differ in reflex and voluntary actions?

Reflexes are much sharper and quicker than voluntary action. Over time, evolution has increased the efficiency for survival by allowing the body to act before we can even think or react. These are reflexes (such as moving your hand from a hot stove or kicking your leg when hit in the right spot on the knee). Because the human body is designed for survival, this evolutionary advantage came to be in order to save us from heat, cold, falling, etc. It would take too long for the nerves to signal the brain – if we did not have reflexes, then we run the risk of being burned or losing our balance.

How do errors in communication impact homeostasis in the human body?

The body receives signals when events such as external temperature rise occurs, which could raise our internal temperature too high. The hypothalamus monitors blood sugar levels, temperatures, etc. and ensures that at all times they are in the healthy margin. If the hypothalamus does not

receive these signals that tell it when something is malfunctioning, then the body will not secrete the hormones (sweat, glucagon, insulin, etc.) to properly correct the problem. Additionally, if the hypothalamus does receive word of unbalance and sends out a signal to secrete certain chemicals, if this message is not carried out properly, than the same negative effect will occur and the body will not be able to maintain homeostasis.

How can biomedical professionals help treat, cure and improve the quality of life of those suffering from nervous system disorders? Biomedical professionals can help patients with certain disorders get the help they need. For example, if a person is unable to move properly due to problems in certain regions of their brain, a physical therapist may be able to help them to regain some of their mobility or adapt to their lack of it.

Certain types of medical professionals may also be able to prescribe various medications to relieve the symptoms of a person with nervous system disorders by perhaps sending the signals that the body is unable to help maintain homeostasis, secrete hormones, sense the world around them, and any help with many other symptoms of these disorders. The quality of life from people with these disorders can be quite dull without proper function of their body. This can be improved with the help of biomedical professionals as they aim to make their lives more comfortable.

What is a hormone?

The thyroid gland is found in front of the trachea and its two main hormones are T3 (triiodothyronine) and T4 (thyroxine). T3 affects many physiological processes of the body – including growth, development, metabolism, body

temperature, and heart rate. T4 has many similar functions. The hormones that are produced from the thyroid gland may be increased or decreased by certain drugs (i. e. birth control, Clofibrate, Estrogens, Methadone, Amiodarone, Anabolic steroids, Lithium, etc.). Growth hormone drugs (such as HGH) can influence the pituitary gland to secrete more growth hormone.

How do hormones interact with target cells?

When hormones are released from a gland, they begin to circulate the blood stream. For this reason they come in contact with most of the cells in our bodies. Yet the hormones will only interact with certain cells (target cells). The target cells have receptors that a particular hormone binds to.

What are examples of endocrine glands and exocrine glands in the human body? Endocrine glands provide hormones for internal means and are transported throughout the body using the blood stream. This includes adrenaline released from the adrenal glands or the hormones released in the pituitary and thyroid glands. Adrenaline along with these other hormones is flowed inside the body via the blood stream. However, Exocrine glands have ducts that allow their secretions to reach the surface of the body. An example of this includes the sweat that is produced as a result of secretion from sweat glands, and exocrine gland.

How do feedback loops help regulate the action of hormones? Feedback loops are important modulators of effects on target areas to maintain homeostasis. A positive feedback loops is a feedback loop where the output of a system is increased with a net positive gain added to the input signal before the main increaser. A negative feedback loop is similar except with a

net negative gain added to the input signal. These systems prevent certain internal means from becoming unbalanced (such as high or low blood sugar and internal temperatures). The hypothalamus oversees much of this.

How can too little or too much of a hormone lead to disease? Hormones help the body to maintain balance. If something is out of proportion, diseases and other medical deficiencies will result. For example, the pancreas secretes insulin and glucagon. If blood sugar is low, it will release glucagon to signal to the liver to release the stored glucose from its cells into the blood stream. Once blood sugar increases again, the pancreas begins to secrete insulin to allow cells to take in glucose and lower blood sugar once again. However, if not enough insulin is produced, then the blood sugar will be unable to lower. This can lead to Type 2 Diabetes or hyperglycemia because blood sugar is abnormal. Likewise, if too much insulin is produced, then blood sugar will continue to drop. Both instances are dangerous and can lead to diseases. Too much or too little of a hormone will throw off homeostasis.

How do humans communicate with the world around them? The world is something that surrounds us. Our bodies allow us to see it, smell it, taste it, touch it, and hear it. Various parts of our body (eyes, nose, mouth, skin, and ears) allow us to do so. We communicate with the world with the help of our senses. We are literally able to communicate by way of mouth with the help of our brains that allow us to decide what to say and to say what we decide. We can also affect the world with actions; this possible with the parts of our brain that allow for motion. To show the world the way we feel about it, we are able to use parts of our brain to convey emotion as well.

How does the power of sight allow humans to communicate with the outside world? Being able to see gives us the advantage of knowing what is happening around us. If we were not able to see the world, we would not be able to respond to the world. By being able to see the world and understand what is happening in it, we can respond with actions, words, emotion, etc.

How is light focused by the eye?

Light enters the eyes through the clear front screen of the eye called the cornea. The cornea's refraction bends the light as to flip it upside-down as they pass through the pupil. The iris can enlarge when light is limited or shrink when there is a lot of it. This allows the pupil to take in more light in the dark and less, focused light in brightness. After passing through the iris, the light rays pass through the natural glassy lens. Light rays pass through a dense gel substance (vitreous) that fills the inside of the eyeball. The light rays come to a sharp point on the retina in a normal eye. The retina then processes the light rays into light impulses via nerve endings and sends these impulses over a million nerve fibers to the optic nerve.

How do the eye and the brain work together to process what we see? The brain and eyes work with the visual system, which allows information from the environment to be interpreted in a process that goes to the visual cortex of the brain. When light reaches the retina, it also reaches the part of the brain that is isolated to serve to convert patterns of light into neuronal signals. Neural impulses are produced and the brain receives signals from the lateral geniculate nucleus as the signals are processed by different parts of the brain to make sense of the images captured by the eye.

How does what we see impact other human body systems?

What we see can cause certain body functions to occur. For instance, if someone's eye were to see a cockroach, the person first makes sense of the image. The next step is to decide what to do with the knowledge. If the person's fight or flight response kicks in, then the endocrine system will secrete adrenaline from the adrenal glands. This will cause the heart to race and blood pressure to rise (affecting the cardiovascular system), eyes to dilate, energy to go to the muscles, digestion slows or stops (digestive system), and other internal and visual means that affect human body systems. This is just one example, but based on how we perceive and feel about the image that we see, we may react in different ways that affect other body systems.

What is visual perception?

Visual perception is the ability to detect and interpret light. The visual system is the specific sensory system of vision. The brain and the eyes work together in order to make sense of the world around us. In fact, the refraction of the lens causes the image we would normally perceive through the eyes alone to appear flipped. The brain is able to make sense of the image and flip it. We are able to perceive motion – the process of determining the speed and direction of objects that move in an image. Peripheral vision is a part of the vision that is seen around the selected field of vision. Visual perception is part of the sensory system.

What does it mean to have 20/20 vision?

How can corrective lenses be used to refocus light and resolve myopia and hyperopia?

How does the eye perceive depth, color and optical illusions? Depth perception is the ability to determine the distance of objects and spatial relations of objects at various distance. The retina is made up of several layers within contain rods and cones. Cones are any of the cone shaped receptors in the retina that respond to color. Rods are the long shaped receptors that respond to faint light. The eye perceives optic illusions because of blind spots in the eye that are due to where the optic nerve enters the eye and is lacking rods and cones. This area is insensitive to light; the brain will often assume what is there and fills it in with what makes sense.

How does an error in the structure or function of the eye relate to disease or dysfunction? If the eye is not structured properly, it will not work properly. The machine analogy can be used again in this case; if one part does not work, the machine or eye is completely useless. Without the cornea, light would not be admitted to the interior of the eye. If the iris were malfunctioning, the eye would not have color and would not be able to alter the amount of light taken in to the eye.

This could easily damage the eyes and cause images to be seen unclearly. If the pupil were not working correctly, light would not be able to be admitted to the inside of the eye. The retina and optic nerve strongly depend on each other. The retina receives images from the lens and converts it to the brain in order to be made sense of. However, it would not reach the brain without

the optic nerve, and without the retina, the optic nerve would have nothing to deliver. All parts of the eye are vitally important and any malfunction in even a single part can lead to disease and dysfunction.

How is life impacted by a vision disorder?

If one is unable to sense the world around them, their entire lives will be utterly altered. Some sort of vision impairment or blindness affects over 10 percent of adults. Activities such as writing, shopping, eating, cooking, learning, and many other daily involvements would be impossible. These simple means in life would be very difficult and adjusting to this can be very difficult for an individual as well as the family.

They would need to learn how to read brail and to use their ability to hear very acutely in order to sense what they cannot see. It may be difficult for many bodily functions to occur; certain hormones that are often triggered by the things we see would not be able to secrete into the body. This includes serotonin, endorphins, dopamine, etc. These hormones can be triggered when we see something pleasing (can come by other means as well).

Without these, people can become depressed, unable to concentrate, and unhappy.